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Book reviews

Antarctic Birds: Ecological and Behavioural Approaches

David Freeland Parmelee
University of Minnesota Press, Minneapolis, (1992).
203 pages. $39.95, £30. ISBN 0 8166 2000 8.

The packaging and title of David Parmelee's new book on Antarctic birds are deceptive; with dimensions of 9" x 11½" it resembles one of the many "coffee-table" style collections of photographs and anecdotes that have recently been published on Antarctica and its wildlife. The book is instead much more like a monograph on the biology of the birds of the Palmer Archipelago, the site of Palmer Station, one of the research bases of the United States Antarctic Research Program. Parmelee and his colleagues worked at Palmer Station more or less continuously from 1973 to 1985 (with breaks in 1981–1983). The book summarizes the research conducted during that period, and also draws heavily on the research of others conducted between 1955 and 1991 in the Antarctic Peninsula and the South Shetland Islands. Whereas the book's presentation is less detailed or "technical" than a monograph, and its style more popular (and thus more readable), it is a uniquely valuable repository of information; those interested in the biology and conservation of birds of the Antarctic Peninsula would be wise to use Parmelee's book as a first reference.

The Antarctic Treaty stipulates that Antarctica should remain free of commercial or military exploitation, and should be preserved in as close to a pristine state as possible, to permit, among other things, the scientific study of its wildlife in an "undisturbed" setting. Thirty years after the enactment of this treaty, we need to ask certain questions: What has been the impact on wildlife of human use of the Antarctic? What is the magnitude of natural variability in population size and reproduction of Antarctic animals? Do we need to impose more stringent regulations on our visits to Antarctica? It is not Parmelee's goal to answer these questions, but his balanced evaluation of the data available at least suggests what problems could develop in the future. In general, there seems to have been little adverse impact on the bird populations of the Palmer Archipelago resulting from human activity there. However, a major oil spill occurred in 1989, and as seabird populations respond on such an extended scale of time, the full effects of the spill cannot yet be assessed. Research at Palmer (Eppley, Z.A. & Rubega, M.A. 1989. *Nature* 340:513, Barinaga, M. 1990. *Science* 249:243) carries the implication that South Polar skuas may be good indicators of environmental damage caused by spilled oil. Parmelee's findings that South Polar skuas had the highest interannual variability in reproductive success of any bird at Palmer, and also foraged almost exclusively in pelagic areas, casts serious doubt on this implication. Instead, Parmelee suggests, blue-eyed shags and Adélie penguins seem to be far better indicators of oil damage.

It seems a fair interpretation of Parmelee's data that diving birds in general (penguins, shags) are more appropriate indicators of long term environmental change than are birds confined to feeding at the surface (many petrels, South Polar skuas); perhaps surface feeding birds are too dependent on capricious variability in the availability of prey.

The treatment of species in the book is a bit uneven. For example the sections on penguins highlight temporal variability in colony size, whereas the section on southern giant petrels focuses on banding returns. Nevertheless, the author directs the interested reader to the appropriate sources of further information in a thorough "Literature Cited" section. Parmelee's talents as a naturalist and writer shine through the entire book; readers will be intrigued by such biological titbits as: 22 brown skuas killed by an outbreak of avian cholera, repeated recoveries of southern giant petrels from Palmer in the Australian region, a vagrant black-necked swan feeding on a krill swarm, a male red phalarope in alternate plumage collected in January, and the fertility of the F1 hybrids of brown and South Polar skuas. The book is illustrated with beautiful colour photographs, and line drawings and colour paintings executed in the author's vivid and inimitable style.

RICHARD R. VEIT

Climate System Modeling

Edited by *K.E. Trenberth*
Cambridge University Press, Cambridge, (1993).
788 pages. £35. ISBN 0 521 43231 6.

This book is logically arranged into six parts Introduction, The Science: Subsystems and Processes, Modeling and Parameterization, Couplings and Interactions, Sensitivity Experiments and Applications, Future Prospects, and 23 Chapters. Each of the chapters are authored by acknowledged experts in the field. The topics covered address the title of the book well and there are no major omissions. Most of the contributions present a thorough grounding of the basic relevant science but also encompass much of the latest work and the major achievements in recent years in the various disciplines (there are close to 1000 papers listed in the references). The physical principles are well discussed as are many of the numerical and computational techniques.

One of the main foci of the book is the complex and interactive nature of the systems which determine climate. In the recent past, research has focused on the individual

components but now it is addressing the problems of coupling the systems. The book brings out this mood very well; there is a good deal of crossing-referencing of chapters and the topics blend into each other easily. It has certainly succeeded as an advertisement for the need for a multidisciplinary approach to climate research. As an example, the specific problem of coupling atmospheric and oceanic General Circulation Models is addressed in a number of contexts. When the 'boundary conditions' of each of these models are specified (e.g., sea surface temperatures in the case of atmospheric models) they perform quite well on their own. However, when used in that fashion they cannot take proper cognizance of the various potential feedback, and their use in a number of topics in climate research is limited. When these models are coupled small flaws feed back on each other and degrade the veracity of the simulation. The book presents some of the latest thinking on this coupling problem.

The volume presents excellent chapters on atmospheric chemistry, marine biogeochemistry, and chemistry-transport models. These topics are often given little attention in compilations such as this but are of great relevance, given the uncertainties and importance of atmospheric budgets of trace gases, the oceanic uptake of anthropogenic CO_2 and the 'ozone hole'.

The book is pleasingly presented and contains 16 colour plates. Most of the graphics are very clean and intelligent use of pink colouring helps to get their message across. In his preface the editor states that the book is especially intended for graduate students. It will certainly will be used profitably by such students in the many facets of climate system research. The volume is essentially one for specialists and is not really suited to the 'intelligent layperson'. It can be recommended to scientists who are keen to update themselves on developments outside their immediate field of interest.

IAN SIMMONDS

Climate modes of the Phanerozoic

L.A. Frakes, J.E. Francis & J.I. Syktus
Cambridge University Press, Cambridge, (1992).
274 pages. £40. ISBN 0 521 36627 5.

The idea of some form of long-term cyclicity in climates is not new. It has been a central theme of research programmes by such distinguished luminaries as R.W. Fairbridge and A.G. Fischer, and of course their goal has been quite clear. Establish the temporal spacing of major climate shifts through time and you are then some way towards explaining their cause.

In this study we are presented with a division of the Phanerozoic eon (approximately the last 600 m.y.) into nine, alternating cool and warm modes. The average length of a cool-warm cycle is somewhere between 159 and 162 m.y.; given the uncertainties of precise dating there would seem to be reasonable agreement there with the 150 m.y. half Galactic Year (a measure of the position of the Solar System within the Galaxy). The identification of cool modes within the latest Precambrian–earliest Cambrian, late Ordovician–early Silurian, early Carboniferous–late Permian and early Eocene–Recent will not trouble most observers, but what of an additional middle Jurassic–early Cretaceous cool phase? The later Mesozoic is classically regarded as a time of greenhouse warmth and lack of any proven glacial deposits is usually taken as a sign of marked asymmetry in major climate cycles. Well aware of the absence of tillite deposits in this interval, the authors point instead to the presence of exotic boulders in various fine-grained strata of Bajocian–Albian age. These may well have been ice-rafted in some form of periglacial environment; seasonal winter ice along rivers and shorelines in the highest latitudes seems the most likely mechanism.

The great strength of this book is that it provides a succinct overview of the key lithological, geochemical and palaeontological data upon which most of our assumptions about Phanerozoic climates are based. Reference to the current crop of climate models is made, especially in the Mesozoic sections, but this is essentially an empirical review. Although each climate mode, be it warm or cool, has a certain degree of integrity, it must be said that each is also marked by its own internal inconsistencies. Thus we find, for example, a late Devonian glaciation in South America during the late Silurian–early Carboniferous warm mode and a Stephanian climatic amelioration during the succeeding cool phase. It is still very hard to judge the true nature and significance of such events.

And so to causes; at the end of this survey are we any nearer to determining the mechanisms of global climate change? A major theme throughout the book is the relationship between long-term change and the evolution of the carbon cycle. Although data are sparse in places, there would appear to have been a striking increase in $\delta^{13}C$ before each episode of glaciation. During a cool mode, when rates of volcanic activity are comparatively low, substantial accumulations of organic carbon can be linked with high productivity either on land or in the ocean. In the succeeding warm mode, a reverse carbon pump liberated carbon to the oceans and atmosphere from the sedimentary reservoir. Quite how this is done is uncertain, but it would appear, from the volumes of carbon involved, that something more than the normal processes of erosion and oxidation may have been involved. Volcanic release of CO_2 was almost certainly an important additional triggering mechanism.

This book provides a stimulating and thought-provoking review of climates through geological time. It will play an important part in formulating the nature of palaeoclimatic research over the next decade.

ALISTAIR CRAME

Confronting climate change: risks, implications and responses

Edited by *I.M. Mintzer*
Cambridge University Press, Cambridge (1992).
382 pages. £50, $80 ISBN 0 521 42109 8.

"Confronting Climate Change" contains 23 papers on a wide variety of climate change issues. The quality of the majority of papers alone should be sufficient to recommend the volume, especially to those teaching a course on global climate change. However, the volume is compromised by the distracting editor's introduction to each paper, and evidence that the volume has been hastily prepared. For example, inconsistent quality of papers, figures and tables unsourced in their captions, and a poor, and sometimes inaccurate glossary. In addition, the publishers should make clear the perceived role of the volume within the rapidly expanding area of climate change literature.

The volume is organized into five chapter groups: I – The Science of Climate Change (five papers); II – Impacts of Global Climate Change (five papers)' III – Energy Use and Technology (three papers); IV Economics and the Role of Institutions (six papers); and V– Equity Considerations and Future Negotiations (three papers).

The first three groups of papers are essentially updated versions of parts of reports produced by the Intergovernmental Panel of Climate Change (IPCC) Working Groups I, II & III. As such they are valuable contributions to the scientific literature on global climate change. Of specific interest to Antarctic scientists is the review paper on "Lessons from the ice cores: rapid climate changes during the last 160 000 years" by Hans Oeschger and Irving Mintzer.

The papers on the Role of Institutions and Equity Issues clearly place this volume as part of the pre-UNCED (United Nations Conference on Environment and Development – June 1992) literature. Although the papers which focus on institutional and equity issues are now superseded by the publication of the Climate Convention, they are nevertheless important summaries of the pre-UNCED situation. The papers in the latter section of the volume also provide an insight into the overall aim of the book.

In summary, if you are intimately involved in the global change field, either in research or teaching, the volume's papers are a useful summary of a range of pre-UNCED issues, and is to be recommended: but be prepared to grit your teeth through the editor's chapter introductions. If you have only peripheral interest in global change issues, wait instead for a collection of papers which describe the implications and issues in the post-UNCED scientific, economic, institutional and political global climate change landscape.

ROBERT KAY

Antarctic fish and fisheries

Karl-Hermann Kock
Cambridge University Press, Cambridge, (1992).
359 pages. £55. ISBN 0 521 36250 4.

The last decade has seen the publication of a series of monographs reviewing aspects of Antarctic science in a global content. This book, on Antarctic fish and fisheries, is a worthy addition to that series by a scientist who has been closely involved in the primary research work for the last 15 years. Both the ichthylological and fisheries science communities have been waiting for this; they will not be disappointed.

The book begins with an account of the ecological status of the Southern Ocean, and then describes the origins, taxonomy and zoogeography of its fish fauna. From there it proceeds logically to physiology – or, better, ecophysiology – and I found the chapter on Environmental Adaptations a fascinating account of the metabolism of cold tolerance. Apart from the means of avoiding being frozen solid at below-zero temperatures, adaptations to Antarctic conditions are essentially extensions of those found in cold-water animals generally. As the author points out. provided you have anti-freeze in your blood, life at -1°C is not as bad as it might seem!

Physiology leads on to the life-history strategy and population biology of Antarctic fishes, again treated on a comparative basis with temperate fishes. It is clear that although Antarctic fishes tend to be longer-lived for their size than those in temperate regions, the differences are marginal. Certainly, such differences as there are between Antarctic and temperate fishes in the main life-history and reproductive parameters, i.e. age and size at maturity relative to maximum size and longevity, are much less than would be expected from simple temperature extrapolation. Thus it seems that compensatory processes equivalent to those governing metabolic adaptations to low temperatures are also manifest at the whole organism level.

Predator-prey interactions and fish in the Antarctic ecosystem provide the transition from ichthyology *sensu strictu* to fisheries science, with a detailed account of the development of commercial fishing in the Antarctic. Starting in the early seventies, this has been prosecuted almost entirely by Eastern-bloc countries, mainly the former Soviet Union. The dramatic declines in catches as the previously unexploited stocks were fished down is clear enough, despite the weakness of the statistical record. In these circumstances it is perhaps surprising that the only stock-recruit arrays presented (for *Notothenia rossi* and *Champsocephalus gunnari* at South Georgia) do not show more obvious signs of recruitment failure. It would be useful to check by simulations whether the VPA method applied to rapidly changing non-equilibrium states with imperfect catch/effort statistics could be misleading – either giving a somewhat exaggerated impression of the true degree of stock depletion or obscuring the real decline in recruitment.

This sad story of yet another example of profligate

exploitation of fish resources is completed with an account, discrete but accurate, of the so far largely abortive efforts of the Commission for the Regulation of Antarctic Marine Living Resources (CCAMLR) to bring about a more rational approach to the harvesting of these intrinsically vulnerable resources. It might have been thought that the former Soviet Union in particular, with their long participation in the scientific work of the ICES and the distressing experience of the severe overfishing of the northern herring and cod fisheries still fresh, would at least have supported the efforts of the Scientific Committee of CCAMLR to obtain reliable records of the initial unexploited state of the stocks and their subsequent decline.

It was not to be. Its first two meetings were rendered abortive by wrangling over procedural points, and even now catch records are seriously flawed. As I know from talking at the time to the first Chairman of the Scientific Committee of CCAMLR, there was a deep sense of frustration among the scientists watching helplessly while stocks were being rapidly depleted without even the evidence being gathered on which to base an eventual stable fishery. As the author comments at the end of the book, economic realities following the abandonment of grossly subsidized fishing are likely to be the only way of bringing relief to the common-property Antarctic fish stocks, as is already happening in the North East Arctic.

The author is to be congratulated on a scholarly synthesis of the ichthyology, ecology and exploitation of Antarctic fish resources. The book is well written and illustrated, with a good bibliography and extracts from the CCAMLR conservation texts. It is an essential on the shelves of all well-founded fisheries libraries.

R.J.H. Beverton

International Law and the Antarctic Treaty System

Sir Arthur Watts
Grotius Publications Ltd, Cambridge (1992).
480 pages. £58. ISBN 1 85701 007 8.

In "International Law and the Antarctic Treaty System" Sir Arthur Watts provides a valuable study of the Antarctic Treaty system as it has evolved through the Antarctic Treaty and related agreements. The author is well qualified to do so. Sir Arthur was a member of the UK delegation to the first Antarctic Treaty Consultative Meeting in 1961 and was later the leader of the UK Delegation during the 1982–1988 negotiations for the Convention on the Regulation of Antarctic Mineral Resource Activities 1988.

The book is an expanded version of lectures delivered in February 1992 at the Cambridge Research Centre for International Law. The narrative reflects a lecture style, providing an overview of legal and constitutional issues which is accessible to the general reader. In particular, the work will be of interest to the international scientific community for, it will be remembered, one of the primary objectives of the Antarctic Treaty was to ensure freedom of scientific investigation. Modern scientists are now resource managers and conservationists and will find the material dealing with the protection of the environment through Specially Protected Areas and Recommendations on oil and marine pollution, tourism and environmental impact of immediate relevance to their research activities

The premise for this work is that not only is Antarctica of value as a unique and vast scientific laboratory but also it is of value to the study of international law. The work distils from Consultative Party practices, differing juridicial perceptions of territorial claimants and non-claimants, scientific activities and heroic expeditions in Antarctica, the laws and principles which now comprise the Antarctic Treaty system.

Issues such as dispute settlement, territorial sovereignty, the definition of Antarctic seas, jurisdiction, enforcement, liability and non-militarization are examined separately by reference to each relevant agreement (CCAS, CCAMLR, CRAMRA & Environmental Protocol) within the Antarctic Treaty system. Analysis of this "legal architecture" demonstrates the complexity of the rules relating to participation in Antarctic affairs by original Consultative Parties, acceding Consultative Parties, Non-Consultative Parties and Observers. A portrait emerges of ritualistic, druidical procedures based on tortured provisions and "knowingly ambiguous phrases". Such provisions and phrases do, nonetheless, have the merit of defusing potential disputes relating to sovereignty claims in Antarctica and in this way, of enabling cooperation "in the interests of all mankind". Indeed, no aspect of the Antarctic Treaty system is comprehensive in the absence of an understanding of the underlying positions of States making claims in Antarctica and those which either make no claim or deny a right to do so. The cornerstone Article IV, which provides that the Antarctic Treaty is not to be interpreted, *interalia*, as prejudicing the respective juridicial positions of the Parties, is rightly identified by Sir Arthur as a good example of dispute management, which, while not solving legal issues, enables parties to cooperate in other aspects of Antarctic regulation and activity.

The opening chapters of this work, dealing with the evolving institutional procedures and powers, provide and explanation for the "commendable haste" in negotiating the Protocol on Environmental Protection in 1991, three years after the adoption by consensus of the Minerals Convention. A general reader might ask how it was the Consultative Parties devoted so much effort to the negotiation of the Minerals Convention which was so rapidly to be undermined by a total prohibition on mining under the Protocol. Had participation in the Antarctic Treaty system been more accessible to the international community and had its procedures been more transparent and outward looking, the Consultative Parties would have understood far earlier that a total ban on mining more accurately reflected public concerns than did the Minerals Convention

which creates a procedure by which mining might have taken place.

While the Minerals Convention has now been overtaken by the Protocol, it remains questionable whether the Protocol itself will ever enter into force. This is because all States which were Consultative Parties on the date the Protocol was adopted must ratify, accept, approve or accede to it; a difficult standard to meet. In the absence of this Protocol, it is assumed that the voluntary restraint on Minerals Resource Activities agreed to in Recommendation XI-1 will continue.

It is in the area of resource management that the contribution of the Antarctic Treaty system to international law is most clearly illustrated. Recommendations under the Antarctic Treaty protect all fauna and flora, a separate Convention protects seals and internationalized regimes have been negotiated to regulate marine living resources and minerals. Sir Arthur also amply demonstrates that the Consultative Parties have reflected international concerns regarding the environment through special Treaty provisions and Recommendations. Examples include the prohibition of nuclear explosions, of the disposal of radio active waste or of any military measures and Recommendations dealing with tourism, waste disposal and oil and marine pollution. These laws provide creative models for international or regional resource management elsewhere in the world. Importantly, the Antarctic Treaty system provides a guide for States in disputed boundary and maritime zones to go forward with effective management and regulatory regimes without jeopardizing their respective legal claims.

The book includes appendices, the Antarctic Treaty and all related agreements, (though not the Recommendations) and a selected bibliography. It provides a valuable source of materials not only for international lawyers but also for those concerned with resource management and international institutional procedures.

Sir Arthur's review of the laws governing Antarctica demonstrates that, while these laws have grown like "Topsy", the regime has a capacity to respond to international environmental concerns and now constitutes a coherent order which may accurately be described as the "Antarctic Treaty System".

GILLIAN TRIGGS

The Geology of Antarctica

Edited by *Robert J. Tingey*
Oxford Monographs on Geology and Geophysics No. 17. Clarendon Press, Oxford, 1992.
680 pages, 243 figs, 40 tables, 1 colour map (back pocket), £95.00. ISBN 0 19 854467 7.

Published results of earth science research in Antarctica are widely dispersed in the international scientific literature. Only in a few specialized monographs, geological/geophysical atlases and small-scale maps, and in six volumes of the proceedings of regular Antarctic earth science symposia, is information summarized in a thematic, geographical and/or continent-wide context. This volume is perhaps the first major publication elaborating the fundamental aspects of Antarctic geology and geophysics in the form of authoritative reviews by leading Antarctic earth scientists with the professional capability for systematic analysis and expert presentation of all the relevant knowledge.

The editor must first be congratulated on a very thoughtful selection of principal topics addressed in the compilation. Indeed the nineteen contributions included in the volume cover the most important aspects of land and marine geology, crustal structure, glacial geomorphology and palaeogeography of the Antarctic region and clearly demonstrate the presence of many unique features critical to studies of our planet.

In Chapter 1 (R.J.Tingey) describes the regional geology, metamorphic petrology and geochronology of the predominantly crystalline Precambrian rocks which constitute the overwhelming majority of bedrock outcrops in East Antarctica and which are also present in the ancient basement of the Transantarctic Mountains and West Antarctica. The Late Proterozoic–Triassic sedimentary cover to the basement, exposed around the craton margin and especially in the Transantarctic Mountains, is summarized by M.G. Laird (Chapter 2) and P.J. Barrett (Chapter 3), and widespread occurrences of Mesozoic igneous rocks, thought to be related to Gondwana break-up, are reviewed by R.J.Tingey (Chapter 4) and by A. B. Ford & G.R. Himmelberg (Chapter 5). By contrast, Chapter 6 focuses on West Antarctica, with a discussion of the crustal evolution of the Scotia arc region from southern South America to the Antarctic Peninsula by P.F.Barker, I.W.D.Dalziel & B.C.Storey; their summary is accompanied by a beautiful colour map supplied in a back pocket of the volume (Tectonic Map of Scotia arc, scale 1:3 000 000, published separately in 1985.

Some unique features of the Antarctic continent, produced by the combined influence of Cainozoic geological and glacial events, are examined in the subsequent five chapters. In the first of these, W.E. LeMasurier & D.C.Rex (Chapter 7) discuss the interrelationship between tectonic and magmatic processes responsible for formation of the Marie Byrd Land Volcanic province. Chapter 8 (J.B.Anderson) summarizes the results of extensive marine geological and geophysical research conducted on the Antarctic continental shelf, and presents a scientific rationale for planning future research activities, including drilling. C.R.Bentley (Chapter 9) devotes his attention to the rocks beneath the ice as deduced from sub-ice topography, seismic refraction measurements, surface and body wave investigations, and gravity observations. All these data convincingly show sharp differences in the crustal structure of East and West Antarctica, separated by a distinct boundary zone along the Transantarctic Mountains and adjacent strip of West Antarctica. The Cenozoic history of the Antarctic ice sheet is reviewed by G.H.Denton, M.L. Prentice & L.H.Burckle

(Chapter 10) who stress the global importance of the ice sheet and give predictions for its future behaviour on the basis of its stability characteristics and an assessment of likely sea level and atmospheric changes. In Chapter 11, B.C. McKelvey discusses the geological and palaeogeographical significance of land and/or ice-based drilling programmes accomplished in the McMurdo Sound area. None of the holes yet drilled has penetrated into preglacial strata, and even the oldest cores (Early Oligocene) from beds at 702 m sub-bottom depth reflect a glacio-marine setting.

Chapters 12–16 can collectively be defined as a major contribution to Antarctic biostratigraphy/biogeography. The invertebrate fossil record of Antarctica is discussed separately for the Palaeozoic (Chapter 12, R.A.Cooper & J.H.Shergold) and Mesozoic–Cainozoic periods (Chapter 13, M.R.A.Thomson). Looking to the land, Chapter 14 (E.M.Truswell) provides interpretation of the Antarctic plant fossil record in terms of history of land vegetation from the Devonian to Tertiary. It is concluded that, throughout much of the Phanerozoic, the Antarctic vegetation was not markedly affected by the near-pole position of the continent and flourished until onset of land glaciation. G.C. Young (Chapter 15) describes the fossil fish faunas from several Antarctic localities: Ohio Range and the Ellsworth Mountains (early Devonian), the Skelton Glacier area (middle-late Devonian), the central Transantarctic Mountains (Jurassic) and the Antarctic Peninsula (Jurassic–Tertiary), and E.H.Colbert (Chapter 16) summarizes the occurrences of Antarctic tetrapod fossils that provided one of the most important arguments for Antarctica's pre-break-up continental history within Gondwana.

The issue of Antarctic mineral resource potential is treated in two succeeding chapters. In Chapter 17, J.C.Behrendt considers scientific aspects of petroleum resource assessment, and concludes that development of Antarctica's petroleum potential is unlikely for at least several decades. Occurrences of hard minerals are summarized in detail by P.D. Rowley, P.L. Williams & D.T. Pride (Chapter 18) who provide an excellent reference base for the assessment of the hard mineral potential of Antarctica.

A final chapter (19; W.A. Cassidy) deals with extra-terrestrial objects the meteorites that have been systematically found in the Antarctic ice sheet in astounding amounts. Almost one-half of the world's collection of meteorites comes from Antarctica, a fact which alone warrants their inclusion in this book.

In conclusion, having briefly reviewed what is included in the book, perhaps I may also be allowed to comment on what is missing. Regrettably I should mention the lack of a general outline of Antarctic geology and tectonics in the light of present-day knowledge of the structure of the lithosphere of the southern high latitudes. Such an outline can only be accomplished on the basis of small-scale overview maps that would provide a common framework to all contributions included in the book and help the reader to conceive their significance in a regional context. More emphasis on presentation and complex interpretation of vast amount of geophysical data recently obtained in Antarctica and the surrounding seas would also be welcome, but let us make no mistake — these and other possible suggestions are just recommendations for future work, and in no sense they can depreciate a highly successful accomplishment by R.J. Tingey and the contributors to his volume.

GARRIK E.GRIKUROV

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